EMF24 Global Scenario Modeler Presentation : Insights from the IMACLIM model

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Insights from the IMACLIM model

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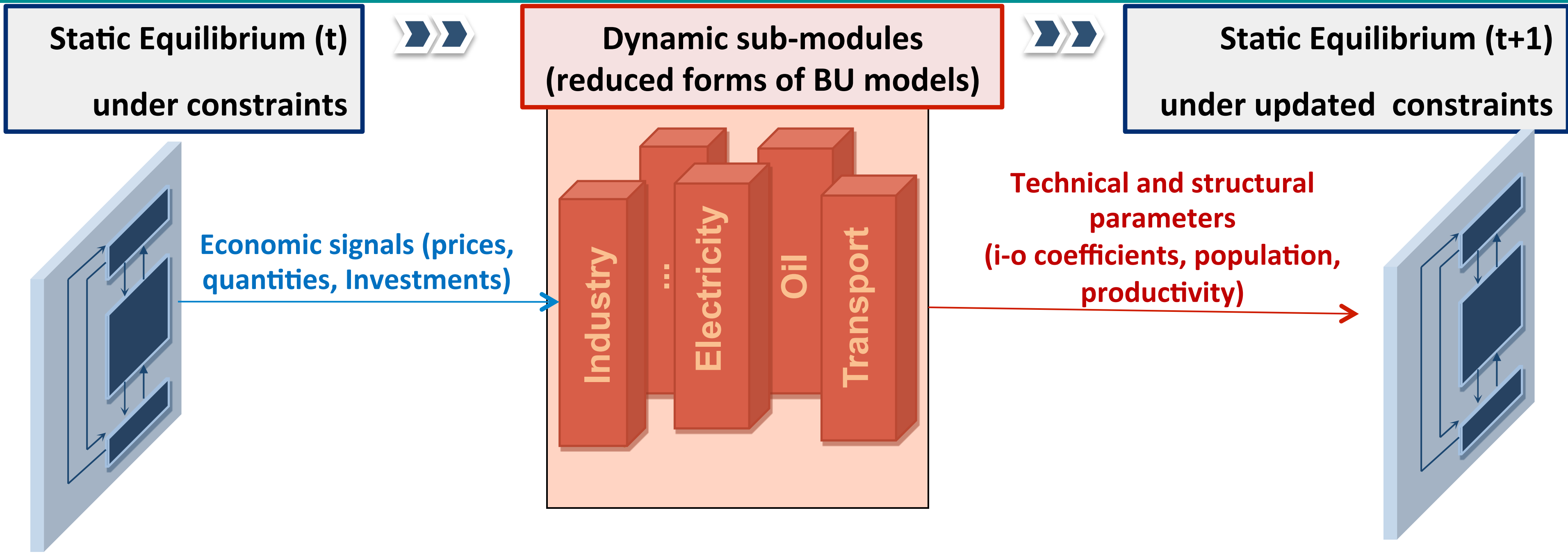
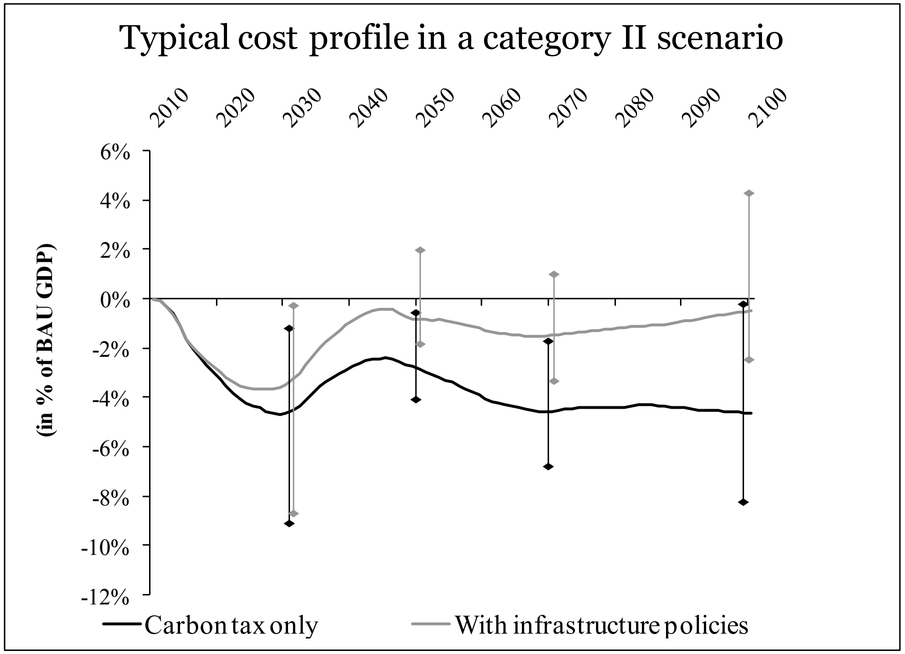
IMACLIM, an attempt to model 2nd best economies in a GE framework

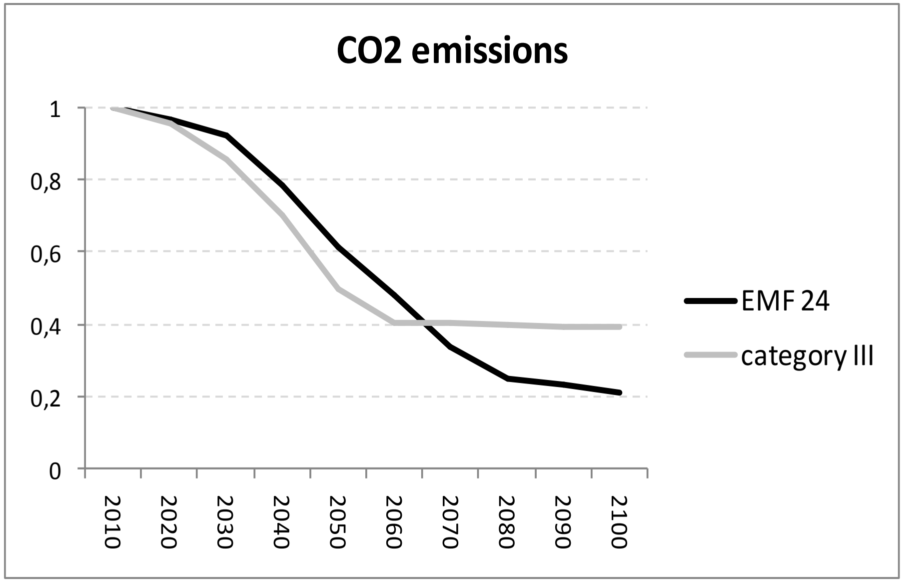


- *Hybrid matrixes in values, energy and « physical » content*
  - Secure the consistency of the engineering based and economic analyses
  - Explicit accounting of inertias on equipement stocks
  - Technical asymptotes, basic needs

- *Solowian growth engine in the long run but transitory disequilibrium*
  - Unemployment, excess capacities
  - Investments under imperfect foresight (informed by sectoral models)
  - Trade and capital flows under exogenous assumption about debts

Why was it so hard to run EMF24 scenarios with IMACLIM?



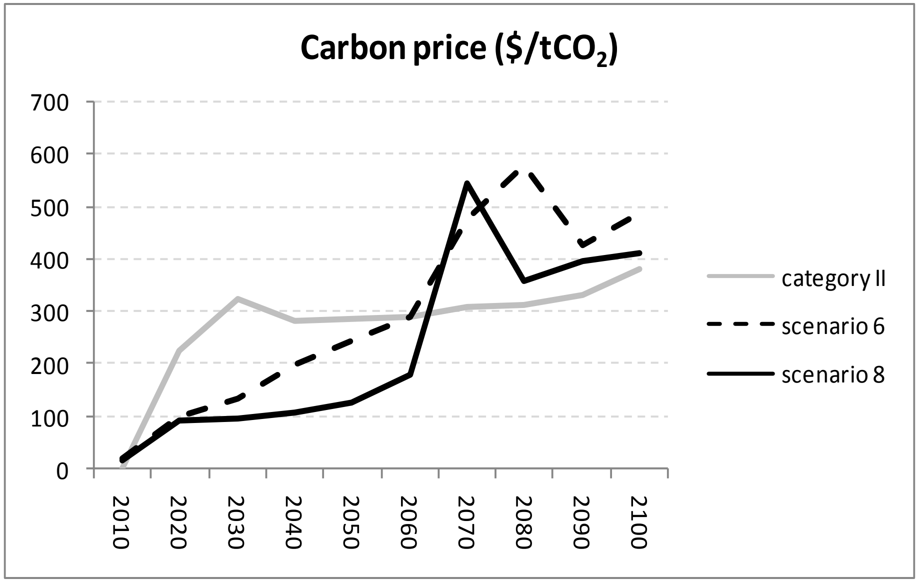


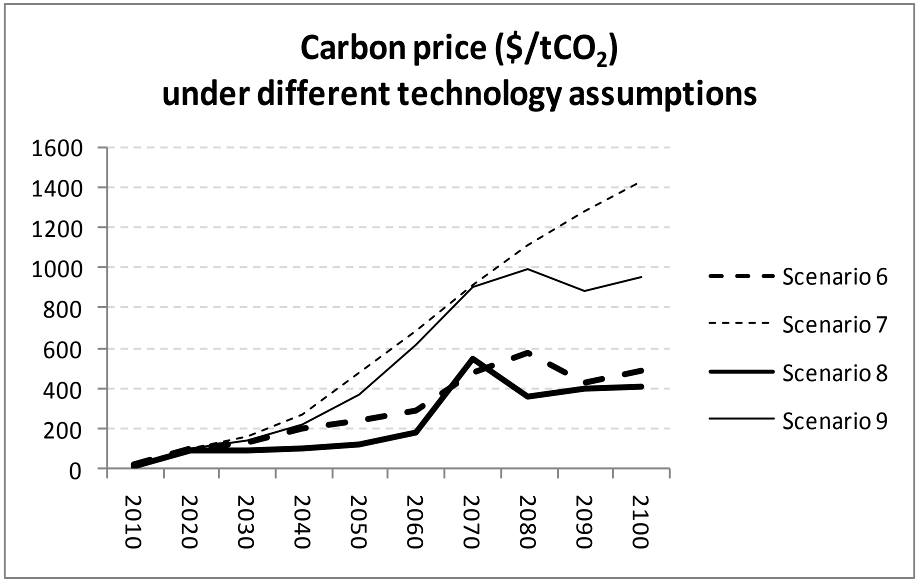
- For a category II scenario (-50% in 2050), typical cost profile of IMACLIM scenarios : high transition costs with moderate LT losses and possible benefits

- Emission trajectories differ in EMF 24 = far stronger reductions in the LT
  - only the most optimistic of the abatement scenarios could be run with our current (conservative?) technological assumptions
  - in other scenarios the technical asymptotes and basic needs were constraining

- Three changes to run the abatement scenarios
  - low basic needs and technical asymptotes
  - non-price induced policies in transportation (automobile, air)
  - sequestration in degraded lands to relax CO_2 constraint

Why so high carbon prices?





In category II scenarios, carbon prices
-- increase fastly over the first decades
(strong signals needed to wake up the half deaf),
-- then stagnate or even decline after 2030 (LBD)

In EMF scenarios, the long run constraints govern the LT increase of carbon price

- Decreasing efficiency of the carbon price when the asymptotes are approached
- Decreasing GDP losses per unit of tax increase (tax revenues returned to the economy) = only 'frictional' GDP losses

The role of technologies

- CCS crucial over the LT
- with CCS, energy efficiency matters for the transition but CCS becomes some form of substitute in the long term

From carbon price profiles to GDP losses, the mechanisms at play

- ***Causal chain of GDP losses:***

  higher energy prices, higher production costs, lower terms of trade for the most impacted economies, lower purchasing power of households (higher energy bills and higher prices of imported goods + lower wages), lower domestic demand

- A catchy way of representing the mechanisms at play (prior to trade effect and technical change)

The rigidity of labor markets

small wage-curve elasticity means high cost

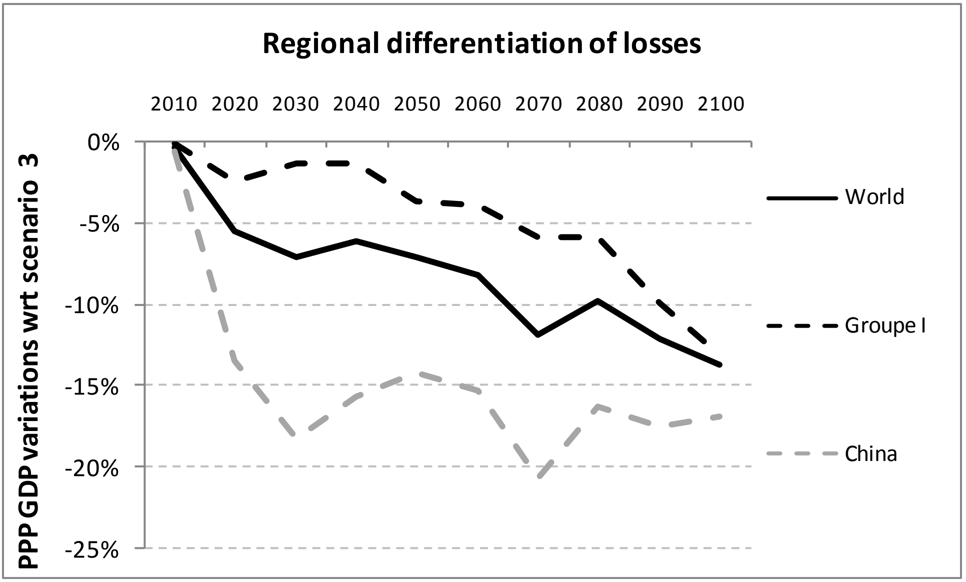
$$\frac{\Delta Q}{Q_0} \approx -\frac{1}{\alpha} \cdot \frac{z_0}{1-z_0} \cdot \frac{e \cdot CI_E}{\omega_0 \cdot l} \cdot \Delta \tau_E$$

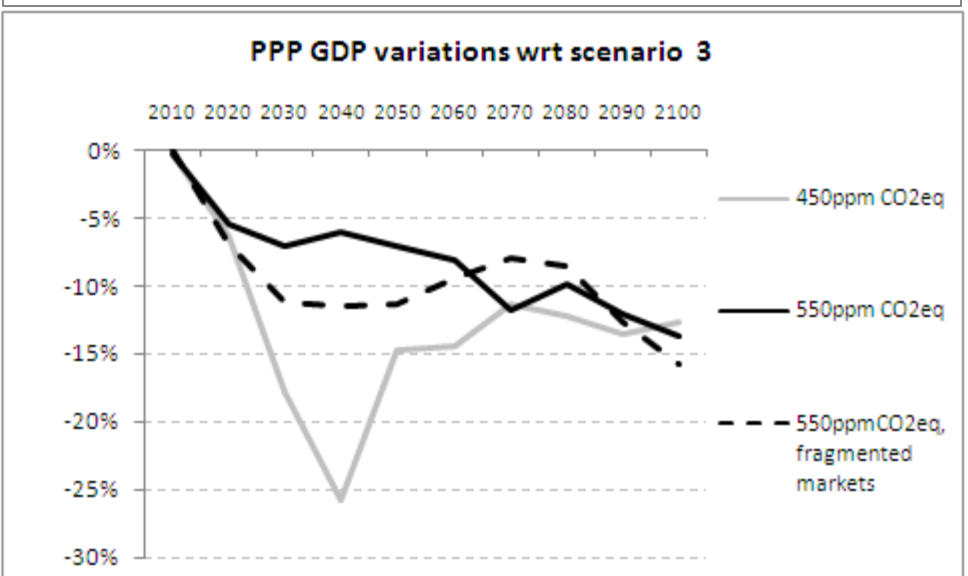
The ratio "energy (carbon) *vs.* salaries".

High energy intensity means high cost

- Over the long run, GDP losses may decrease over time depending on a tradeoff
  - Benefits from ITC that decrease energy intensity and correct sub-optimalities of baseline scenarios (peak oil)
  - Necessity to increase carbon tax rates

From carbon prices to GDP losses





<u>Regional distribution of GDP losses</u>

- in the transition: moderate in OECD countries, high in China (energy-intensive)
- in the long term: continuous increase of GDP losses

Without:

- Compensatory transfers to dev. countries
- Local fiscal policies
- « deus ex machina » technology (alternative tech. availability changes LT costs)

<u>Climate objective and coordination:</u>

- ➢ 450ppm needs a fast decarbonization which comes at a very high transitory cost (inertia and imperfect foresight)
- ➢ G8: very high transitory cost (OECD) but recovery after 2050 (dev. countries)
- ➢ Long term: similar efforts in all scenarios

Pending questions for further analyses

- The role of the emission time profile (RCP emissions) : when flexibility and transition costs

- Sensitivity tests about technological assumptions (cost-potential after 2050) because they determine the nature of the constraint over the long term

- Tests of the role of non price induced policies (in transportation and infrastructures) and of alternative assumptions about consumption patterns